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(71)(72) Applicant and Inventor: KRØYER, Karl, Kristian, Kobs [DK/FR]; Le Vieux Moulin, 12, rue de la Libération, F-06520 Magagnosc (FR).

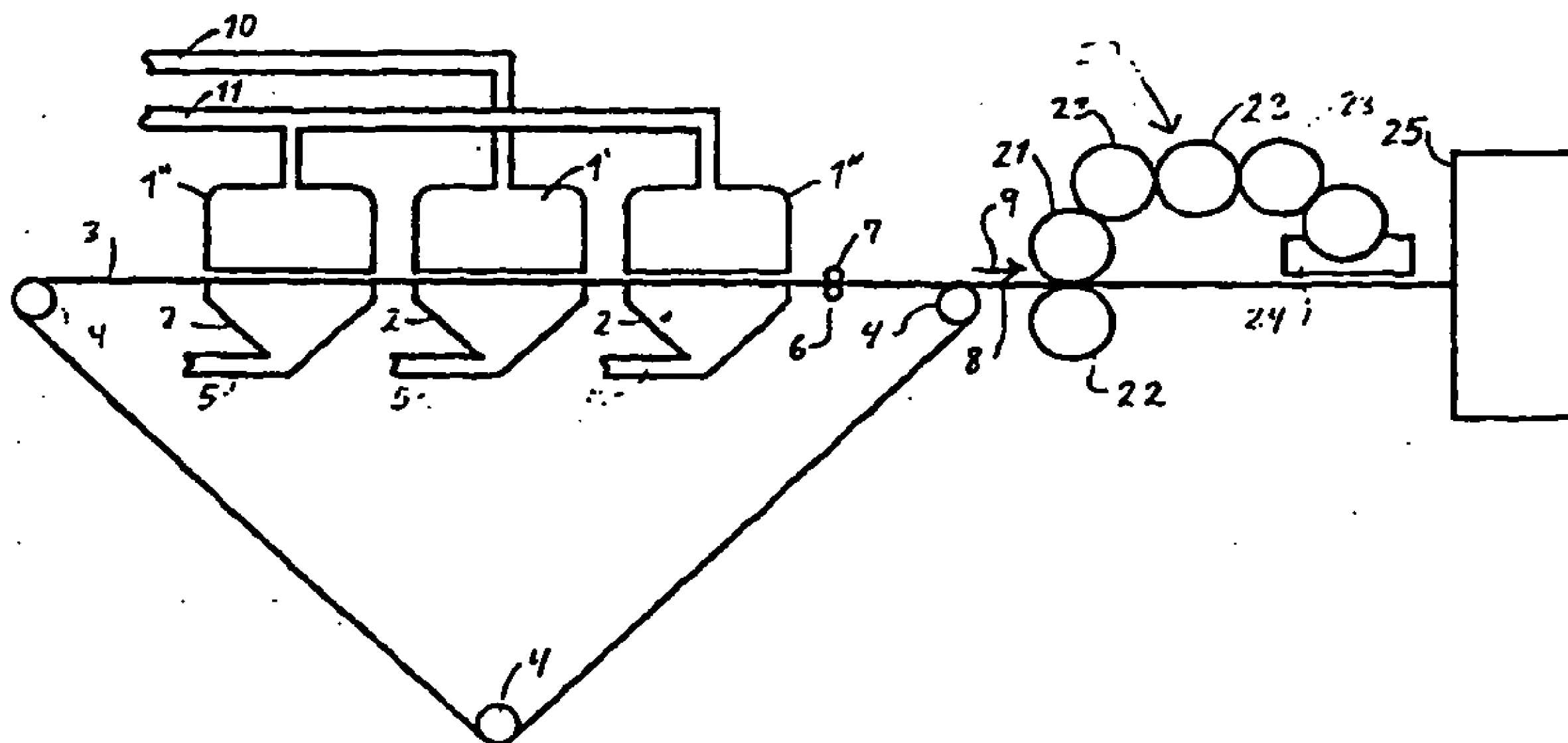
(74) Agent: LEHMANN &amp; REE A/S; Grundtvigsvej 37, DK-1864 Frederiksberg C. (DK).

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Published

With international search report.

(54) Title: METHOD OF PRODUCING FLOW LINES IN A SANITARY PRODUCT



## (57) Abstract

A method of making sanitary products giving a high wearing comfort is disclosed. The method comprises steps of forming three superposed interconnected layers (14, 15, 16). The outer layers (14, 16) are made of hydrophobic fibers and the intermediate layer (15) is made of hydrophilic fibers. The top sheet of the sanitary product is constituted by the layer (16). In this outer layer flow lines are made by means of an embossing roller (21) having a pattern of raised ridges. The ridges are provided with a penetrant which then is applied to the front sheet (16) thereby neutralizing the hydrophobicity of the fibers and thereby providing a pattern of flow lines being hydrophilic and allowing a body liquid to flow through the front sheet (16).

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**METHOD OF PRODUCING FLOW LINES IN A SANTARY PRODUCT**

5 This invention concerns a method for production of a sanitary product comprising three interconnected layers, viz. a liquid impervious back sheet, a liquid impervious front sheet, and a liquid pervious core. More specific the invention concerns a method for producing such product by means of a plant used for making multiply paper. The sanitary products in question might be diapers, sanitary napkins and the like.

10 It is customary to manufacture sanitary products having the liquid impervious back sheet and front sheet made of elastomer sheets and to have the liquid pervious absorbent core comprising a fibrous material interspaced between the front sheet and back sheet. The front sheet and back sheet is sealed along the marginal edge in order to contain the absorbent core in a secure way. In such products it is possible to establish flow lines or flow areas by providing through going holes in the front sheet.

15 The prior art product would suffer from several drawbacks. As rather narrow sealings are used along the marginal edge there is a risk that the sealing is broken whereby the absorbent core might fall out. There will be a need for correct positioning of the products. A highspeed production of the product is difficult to obtain.

20 The final product will give the user a poor wearing comfort due to the elastomer front sheet. Moreover, the final product would have a thickness which could be rather large.

25 It is an object of the present invention to provide a method making it possible to remedy the drawbacks of the prior art methods thereby providing sanitary products giving a high degree of wearing comfort in that it is very thin and have a soft and pleasant front sheet for contact with the user.

30 Moreover, it is an object of the present invention to provide a method making it possible to manufacture the sanitary product in a plant intended for making multiply paper. A not limiting example of such plant for dry forming several fibrous layers on a forming surface has been disclosed in US 3.976.412.

According to the present invention a method is provided for the manufacture of the above-mentioned sanitary product wherein the liquid impervious back sheet and front sheet are made of hydrophobic fibers whereas the liquid pervious core is made of hydrophilic fibers, wherein the hydrophobic front sheet is prepared by a striking roller having a pattern of raised ridges whereto a penetrant is applied for neutralizing the hydrophobicity of the fibers in the hydrophobic front sheet thereby providing a pattern of flow lines being hydrophilic and allowing for a liquid flow through the front sheet.

As the three layers are provided by a fiber laying it is possible to use three successive fiber distributors in a paper manufacturing plant when making the sanitary product. The application of penetrant according to any pre-selected pattern is easily effected by use of the striking roller.

According to a preferred embodiment it is possible to use an embossing roller as a striking roller. It is customary to have an embossing or pressure roller arranged following the fiber distributors in a plant for dry-laying of paper. Accordingly, only very small modifications are required in the plant.

When using an embossing roller it is possible to provide grooves thereby enhancing the wearing comfort of the product as the penetrant is provided in the bottom of said grooves. Thus a fluid will be directed against the bottom of the grooves and thus in direction of the flow lines. Accordingly, such product would provide a surface for contact with the user which is completely dry due to the hydrofobic fibers in all areas outside the grooves.

Moreover, the use of an embossing roller will comprimate the fibers in the flow lines. Due to the intimate contact between the hydrophilic fibers in the front sheet and in the core the liquid guidance or the wicking effect becomes more efficient. Thus any liquid would immediately be guided to the absorbent core thereby very quickly leaving the contacting surface of the front sheet dry.

There will be no risk that the individual layers are separated. As the layer is made by following fiber distributors in a paper-making plant the product will have a coherence corresponding to that of multiply papers being manufactured by application of several layers. Thus there will be a bonding between the layers over the total area. Accordingly, it is not necessary to rely on a connection in the marginal area only.

According to a preferred embodiment the embossing roller is manufactured in such a way that the pattern of flow lines are provided in limited areas which are intended for a preselected position in the final sanitary product. Thus it is possible to provide the pattern in an area which is especially suited for the specific sanitary product. Thereby the wearing comfort is enhanced as liquids might be guided through the front sheet in an area of the sanitary product arranged facing against a discharge opening for the body fluid in question.

According to an especially preferred embodiment superabsorbents are admixed to the hydrophilic fibers of the absorbent core. Hereby the absorbing capacity is increased whereby also the wearing comfort is increased. Thus the risk that any fluid will leak out from the absorbent core is obviated even if a large amount of liquid has been absorbed.

According to a further embodiment the superabsorbents are provided only in areas which are intended for a pre-selected position in the final sanitary product. Hereby it is possible to obtain sanitary products being especially suited for different use, e.g. as diapers for boys and diapers for girls.

According to a further embodiment it is possible to spray the penetrant onto the surface of the hydrophobic front sheet by a series of nozzles. However, the use of a striking or embossing roller is preferred. When using nozzles being guided for providing the penetrant in a pre-selected pattern of flow lines it is possible to use a computer control. This makes it possible to change the production very quickly in order to manufacture sanitary products having different pattern of flow lines. Thus it will be possible in the same plant to manufacture diapers for boys and diapers for girls

with out the need of exchanging any mechanical components of the plant.

5 In general it will be very easy to feed three successive distributors with different types of cellulosic fibers being pre-treated in order to provide hydrophobic fibers and hydrophilic fibers for the different layers.

10 The fibers to be used in the present invention comprise cellulosic fibers, wood fibers, mixtures with synthetic fibers including bicomponent fibers and synthetic fibers. The synthetic fibers may e.g. be of polypropylene or polyethylene. Also glasfibers, rock wood fibers, and pretreated fibers may be used.

Further features and advantages of the present invention will be understood by reference to the attached drawings taken in conjunction with the ensuing discussion.

#### 15 DESCRIPTION OF THE DRAWINGS

In the drawings,

Fig. 1 is a schematic view of an apparatus for use in a method according to the invention,

20 Fig. 2 a schematic view corresponding to Fig. 1, however, illustrating a further embodiment of an apparatus,

Figs. 3 and 4 show schematically two embodiments of a sanitary product manufactured by a method according to the invention, and

Fig. 5 a partially enlarged cross-sectional view through a product manufactured by a method according to the invention.

25 Preferred embodiments for an apparatus for use in a method according to the present invention is schematically illustrated in Figs. 1 and 2. In these Figures identical or corresponding elements are designated with the same reference numbers and will only be explained in details in connection with Fig. 1.

30 The apparatus includes three fiber distributors 1 and three suction boxes 2. An endless foraminous forming wire 3 passes therebetween. The forming wire 3 consists e.g. of

a mesh net constructed using bronze wires. The forming wire 3 is guided on rollers 4 and is driven by driving means which are not shown. Each of the suction boxes 2 is connected with a suction pipe 5 which is connected to a fan (not shown) for creation of a vacuum therein. The forming wire 3 passes through the nip of a pair of rollers 6,7 thereby providing a comprimation of the web 8. The fibrous web 8 is advanced according to an arrow 9.

The intermediate suction box 1' is connected with a supply pipe 10 in order to supply fibers, preferably cellulosic fibers being pre-treated thereby making the fibers hydrophilic. The two outermost distributors 1'' are connected with a supply pipe 11 through which fibers are supplied to the outermost distributors 1''. These fibers are cellulosic fibers being pre-treated in order to make them hydrophobic.

As it occurs from Fig. 1 the web 8 formed in the apparatus comprises two outermost layers consisting of hydrophobic fibers and an intermediate layer of hydrophilic fibers.

The web 8 is used for the manufacture of a sanitary product 12,13 (See Figs. 3 and 4). The sanitary product 12,13 comprises a back sheet 14, an intermediate layer 15 and a top sheet 16 intended to be in contact with a user (See Fig. 5). The top sheet 16 and the back sheet 14 which consist of the hydrophobic fibers will be liquid impervious as it is known from ordinary diapers, sanitary napkins etc. The intermediate layer 15 consisting of the hydrophilic fibers is liquid pervious or absorbent as known from the absorbent core of ordinary diapers, sanitary napkins, etc. In order to make the sheet 8 formed suitable for use as a sanitary napkin a pattern 17,18 (See Figs. 3 and 4) of flow lines 19 is made in the top sheet 16.

This pattern 17,18 of flow lines 19 may be provided in selected areas as illustrated in Figs. 3 and 4. Alternatively, it is possible to provide the flow lines 19 across all the surface of the product formed.

The flow lines 19 are provided by use of means 20 for providing flow lines to be explained in more detail below.



Fig. 1 illustrates the means 20 for providing flow lines in the form of a roller 21 cooperating with a pressure roller 22 on the opposite side of the web 8. The roller 21 is through a series of rollers 23 supplied with a penetrant from a reservoir 24. The penetrant is transferred to the roller 21 which is an embossed roller having a pattern of raised ridges (not shown in detail) corresponding to the pattern of flow lines 19 which are intended to provide in the web 8. The roller 21 might be a striking roller which does not exert an embossing in the web 8. However, it is preferred that the roller 21 is urged against the pressure roller 22, so that an embossing of the web is performed simultaneously with the application of the penetrant.

The penetrant will effect the property of the hydrophobic fibers whereto it is applied. Accordingly, these fibers become hydrophilic. Hereby it is allowed for any liquid to pass through the top sheet and to be absorbed by the hydrophilic fiber arranged in the intermediate layer 15, which may also be called an absorbent core.

After application of the penetrant the web 8 is guided into means 25 for cutting out appropriate forms for the final sanitary product. These forms might e.g. be those illustrated in Figs. 3 and 4. However, it is also possible to manufacture other forms. After the cut the sanitary product is ready for use.

As mentioned earlier it is especially advantages to use an embossing roller 21. As illustrated in Fig. 5 an embossing roller provides the pattern of flow lines 19 in the bottom of grooves 26 formed by the raised ridges of the embossing roller 21. The grooves will direct any liquid directly to the hydrophilic flow lines 19. Thereby the surface 26 of the top sheet 16 which is intended for contact with the user will remain dry. Thereby a high wearing comfort is obtained. Moreover, it is beneficial to use the embossing, seeing that the comprimate hydrophilic fibers in the flow lines will be in more intimate contact with each other and the hydrophilic fibers in the intermediate layer 15. Thereby a more efficient liquid guidance is obtained. It could be said that the flow lines act as wicking means, leading any liquid into the intermediate layer.

The intermediate layer 15 may be provided with superabsorbents 28 in order to



increase the absorbing capacity. As the outermost layers 14,16 are liquid impervious any liquid being transferred to the intermediate layer 15 will remain in that layer. If superabsorbents 28 are used the retaining ability is more efficient. Thus a larger amount of liquid may be absorbed and retained in the intermediate layer 15.

5

The method to be effected in the plant illustrated in Fig. 2 differs from the above explained in that the means for providing the flow lines are different. In Fig. 2 a serie of nozzles 29 are used for applying the penetrant 30. According to this method the penetrant is applied to a web which is not mechanical deformed. However, the nozzles 29 may be controlled by a computer 31. Thus it is possible to make very quick changes in the production. Thus it is possible to manufacture e.g. diapers for boys and  
10      diapers for girls without the need of any mechanical interference in the plant. Moreover, it is possible optionally to provide flow lines over the total area or in selected areas only.

15

The sanitary product 12,13 illustrated in Figs. 3 and 4 represents a child's diaper 12 and a sanitary napkin 13, respectively. In Figs. 3 and 4 preferred embodiments are shown illustrating that the pattern 17,18 of flow lines 19 only are provided in selected areas. When the flow lines are provided in selected areas only, it is possible to provide  
20      a sanitary product 12,13 which is specific manufactured for its specific use. Moreover, the reduced number of flow lines provided in a pre-selected area will reduce the risk of leakage of fluids from the intermediate layer 15.

**CLAIMS**

1. A method for production of a sanitary product comprising three interconnected layers, a liquid impervious back sheet, a liquid impervious front sheet, and a liquid  
5 pervious core, wherein the liquid impervious back sheet and front sheet are made of hydrophobic fibers whereas the liquid pervious core is made of hydrophilic fibers, characterized in that the hydrophobic front sheet is prepared by a striking roller having a pattern of raised ridges whereto a penetrant is applied for neutralizing the hydrophobicity of the fibers in the hydrophobic front sheet thereby providing a  
10 pattern of flow lines being hydrophilic and allowing for a liquid flow through the front sheet.
2. A method according to claim 1, characterized in that the striking roller is an embossing roller, and that raised ridges on the embossing roller are provided  
15 with the penetrant for neutralizing the hydrophobicity of the fibers in the front sheet.
3. A method according to claim 2, characterized in that the embossing process provides a pattern of grooves, and that the hydrophilic flow lines are provided in the bottom of said grooves.  
20
4. A method according to claim 1, characterized in that the pattern of flow lines is provided only in areas which are intended for a pre-selected position in the final sanitary product.
- 25 5. A method according to claim 1, characterized in that superabsorbents are admixed to the hydrophilic fibers provided in the absorbent core.
6. A method according to claim 5, characterized in that the superabsorbents are provided by adding only to selected areas of the hydrophilic layer forming the  
30 absorbent core.
7. A method according to claim 1, characterized in that the sanitary product

is manufactured simply by cutting out appropriate forms of the multi-layer sheet formed.

5 8. A method for production of a sanitary product comprising three interconnected layers, a liquid impervious back sheet, a liquid impervious front sheet, and a liquid  
10 pervious core, wherein the liquid impervious back sheet and front sheet are made of hydrophobic fibers whereas the liquid pervious core is made of hydrophilic fibers, characterized in that a series of nozzles spray the penetrant onto the surface of the hydrophobic front sheet according to a pre-selected pattern, said penetrant being  
15 applied for neutralizing the hydrophobicity of the fibers in the hydrophobic front sheet thereby providing a pattern of flow lines being hydrophilic and allowing for a liquid flow through the front sheet.

9. A method according to claim 8, characterized in that said nozzles are  
15 guided for spraying the penetrant onto a pre-selected area thereby establishing a predetermined pattern of flow lines only in said pre-selected area.

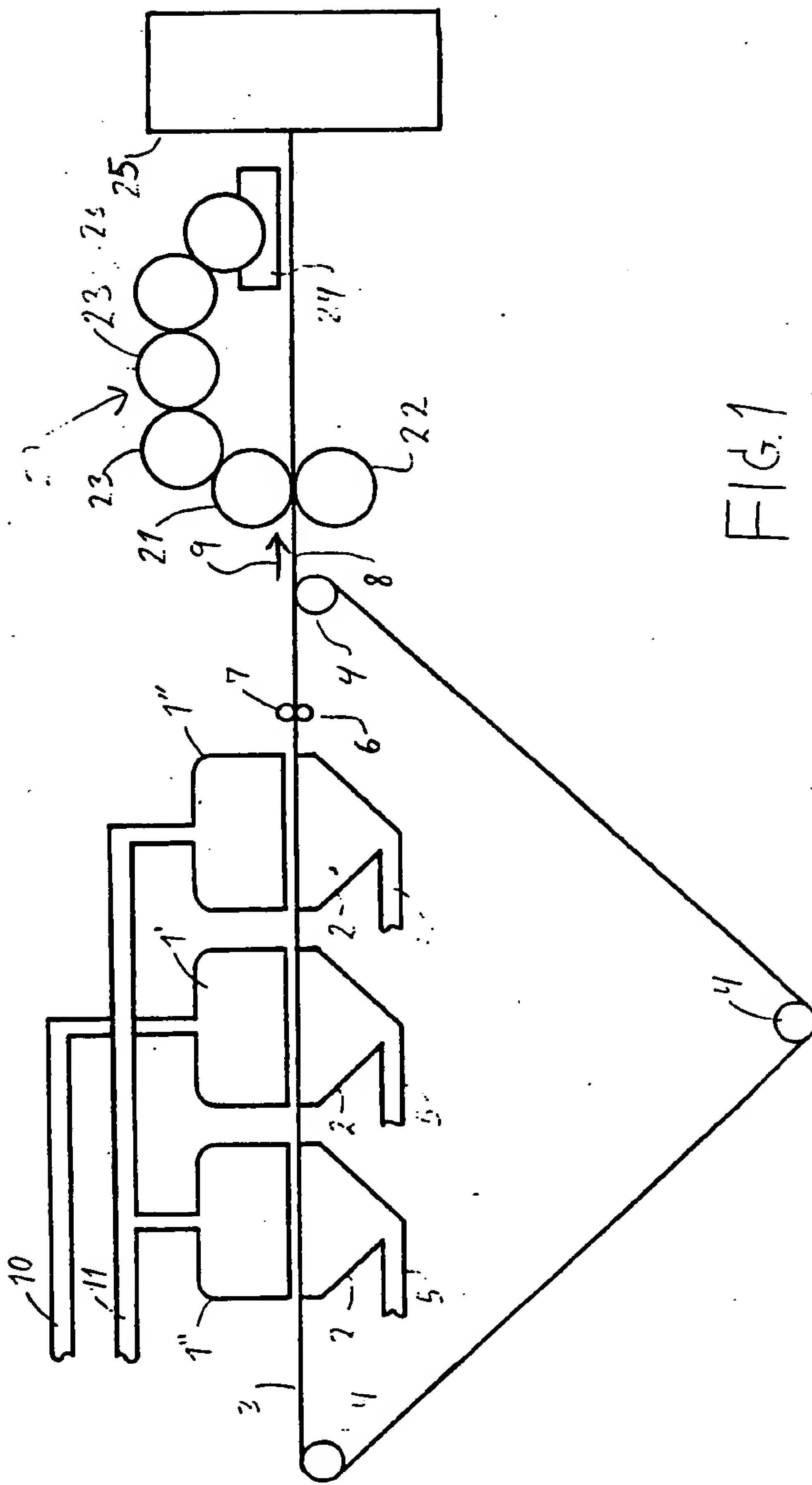
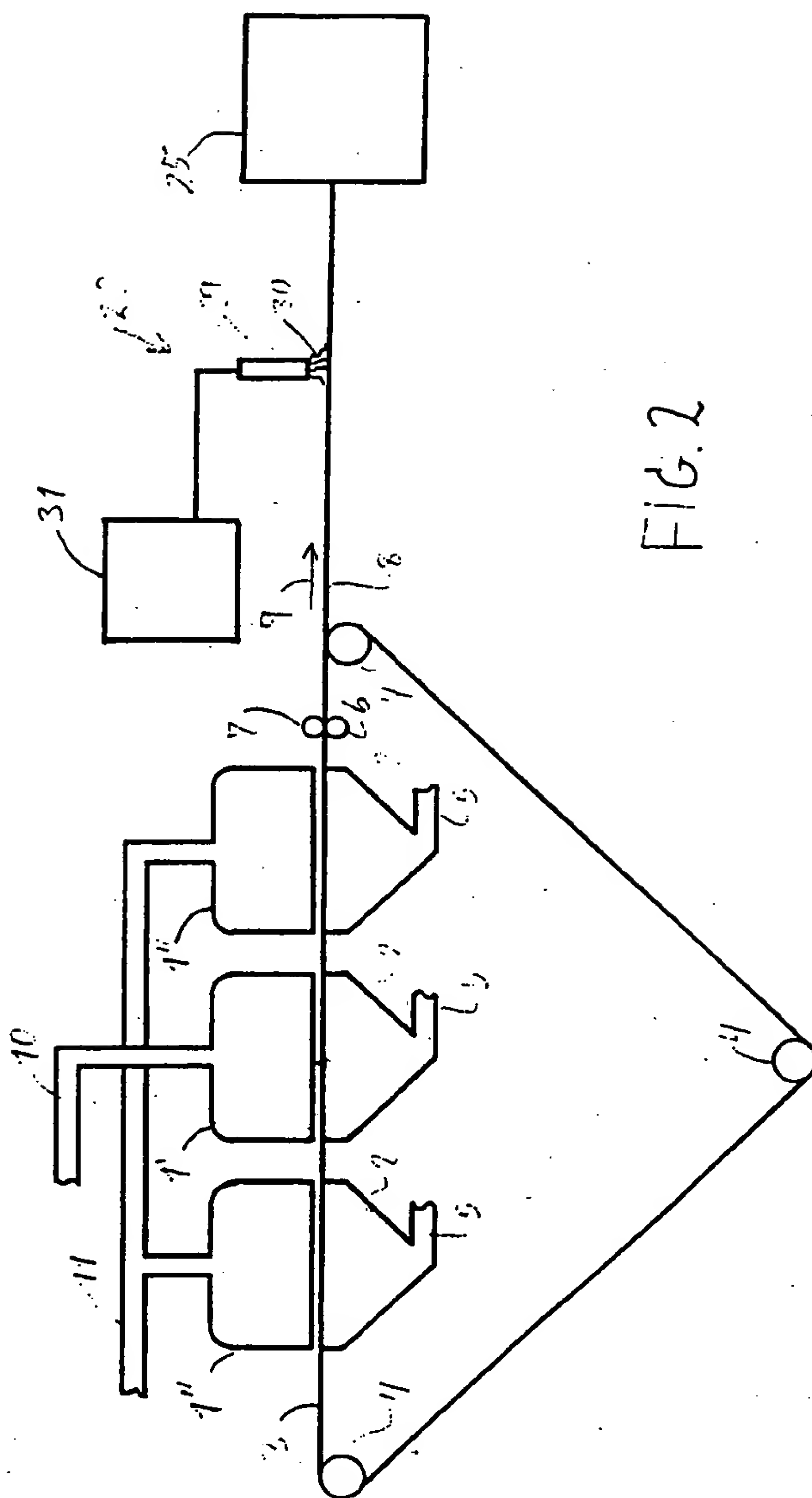


FIG. 1



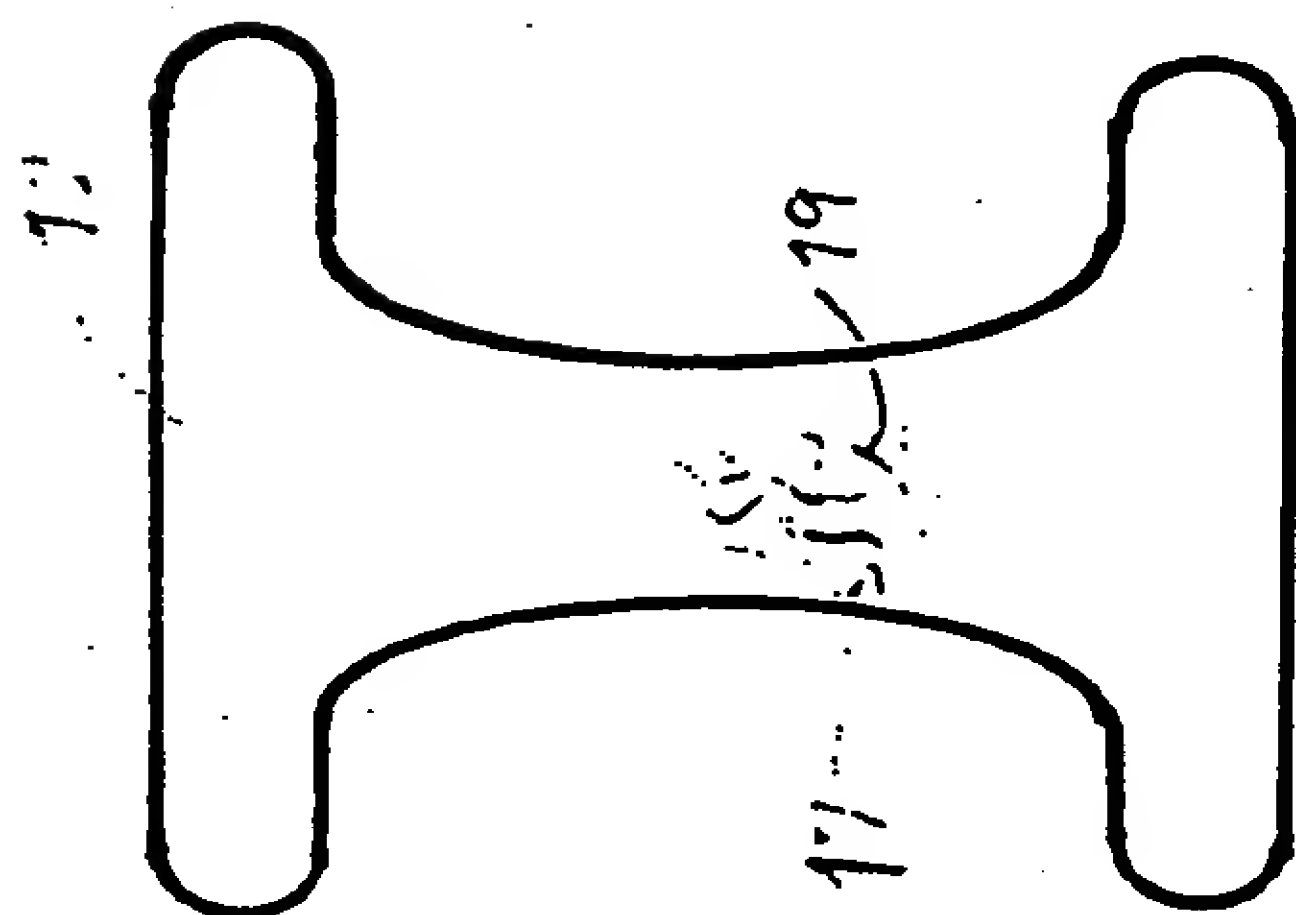


FIG. 3

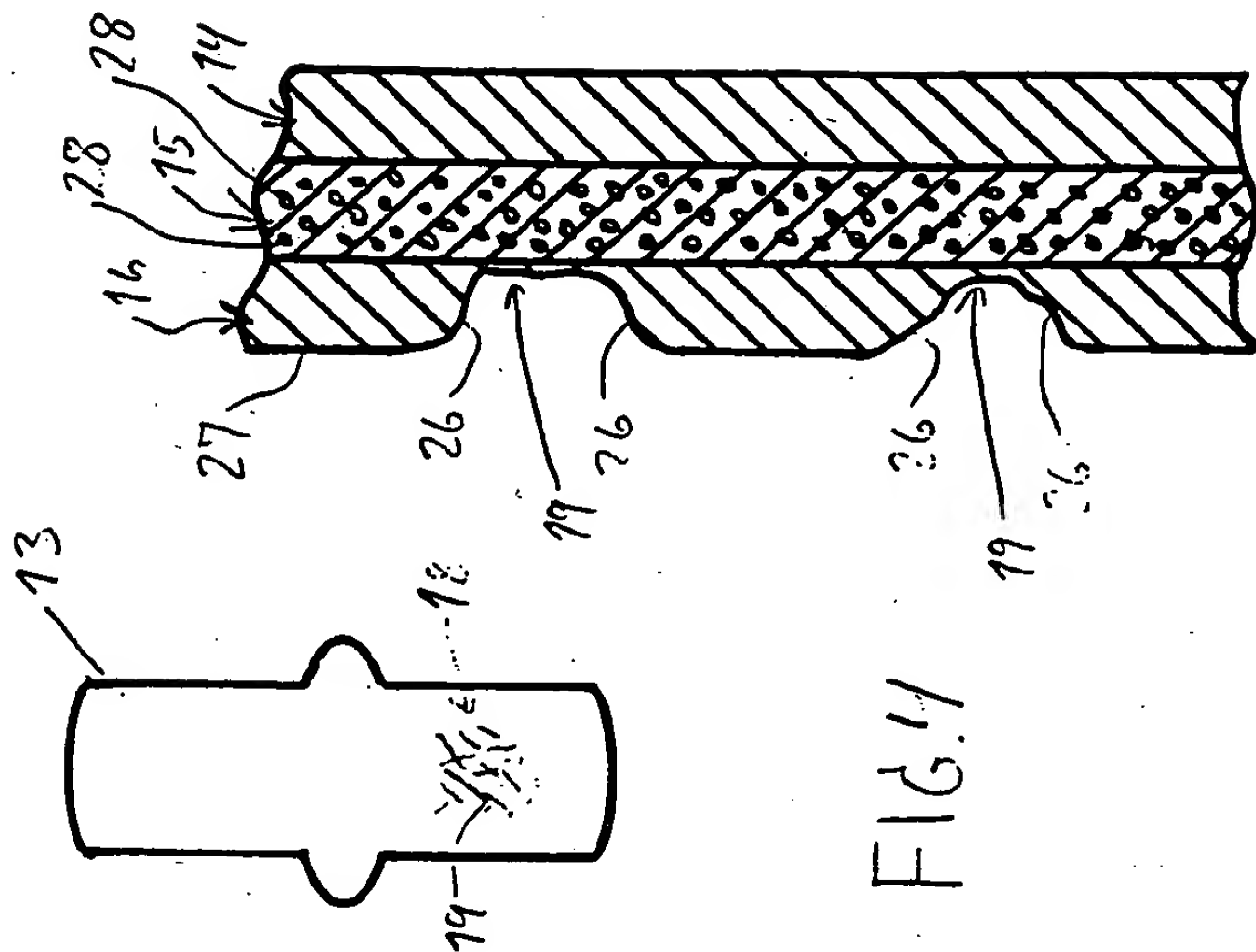


FIG. 4

FIG. 5



## A. CLASSIFICATION OF SUBJECT MATTER

IPC6: A61F 13/15 // A61F 013/46

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: A61F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

DERWENT WORLD PATENT INDEX

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US, A, 4820294 (RONALD R MORRIS), 11 April 1989 (11.04.89), column 4, line 6 - line 36, abstract --	1-3,5-7
X	WO, A1, 9014813 (COROVIN GMBH), 13 December 1990 (13.12.90), page 10, line 14 - line 22, abstract --	1,4,8,9
A	US, A, 3838692 (YVON G. LEVESQUE), 1 October 1974 (01.10.74), column 3, line 2 - line 5; column 5, line 56 - line 60; column 6, line 8 - line 13, see column 6 line 46 - 56 --	1-9

☒ Further documents are listed in the continuation of Box C.☒ See patent family annex.

## \* Special categories of cited documents:

- "A" document defining the general state of the art which is not considered to be of particular relevance
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Date of the actual completion of the international search

23 January 1995

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Authorized officer

Ingrid Falk  
Telephone No. +46 8 782 25 00

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	<p>US, A, 3837343 (FREDERICK K. MESEK), 24 Sept 1974 (24.09.74), figures 6,7</p> <p style="text-align: center;">-- -----</p>	1-9

**Box I** Observations where certain claims were found unsearchable (Continuation of Item 1 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:  
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:  
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
3. ☐ Claims Nos.:  
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

**Box II** Observations where unity of invention is lacking (Continuation of Item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

Claims 1-7 are related to a method in that the penetrant is applied by a striking roller having a pattern of raised ridges.

Claims 8-9 are related to a method in that the penetrant is applied by a series of nozzles spray.

The technical relationship between the two inventions defined in the claims lack a common special technical feature, which defines a contribution over prior art.

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☒ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.  
☐ No protest accompanied the payment of additional search fees.

**INTERNATIONAL SEARCH REPORT**  
Information on patent family members

31/12/94

International application No.  
PCT/DK 94/00403

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
US-A-	4820294	11/04/89	CH-A-	673769	12/04/90
			JP-A-	63029640	08/02/88
			US-A-	4755413	05/07/88
-----					
WO-A1-	9014813	13/12/90	DE-A,C-	3917791	06/12/90
-----					
US-A-	3838692	01/10/74	NONE		
-----					
US-A-	3837343	24/09/74	NONE		
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